

# PROMOTING PEACE BY EDUCATING GLOBALLY COMPETENT ENGINEERS

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**Abstract** – Engineering education focuses on finding solutions to societal challenges. The phenomenon of globalization continues to relax the societal boundaries. Communication technologies have shrunk the distances through increased connectivity. Flow of information around the globe is almost instant. The world has essentially become a global village. The concept of society and societal challenges continue to evolve. Engineers frequently find themselves working in multinational projects and multinational teams. Understanding and respecting various cultures must of an integral part of training engineers to be effective in such environments. It is, therefore, essential to produce engineers with global competencies which include respect for diversity, difference of opinions, ethics, and multicultural social skills. When put in practice, these aspects bring tranquility, lead to social justice, and eventually to a peaceful world. This paper discusses a process to produce globally competent engineers with skills to promote peace. The paper includes curricular changes necessary to impart global competencies.

**Keywords** — *Engineering Education; Promoting Peace; Global Competencies; Globalization*

## I. INTRODUCTION

We all know that knowledge is considered power. We also hope that knowledge, after acquiring it, is put to a good use to help fellow human beings and not to hurt them. Education leads to learning and acquiring knowledge. Education transforms lives and hope that transformation is positive that leads to a peaceful society and a better quality of life for all of us. The process of education and imparting knowledge has evolved over the course of history. The process of globalization has enhanced access to education as well as spread of knowledge. Engineering education is particular interest worldwide because that deals with societal challenges and their solutions. This paper discusses means of educating engineers with a focus of global competencies so that they can play an effective role in promoting peace and living it.

The phenomenon of globalization evolves with the continuously increasing interactions among groups,

corporations, societies, nations, and countries. Some of these global interactions and their consequences are viewed as intended and some as unintended. Altbach and Knight [1] define globalization as a process of economic, political, academic, and societal (including cultural) forces pushing for greater international involvement.

A recent report by the American Council on Education [2] suggests that the phenomenon of globalization has created a climate of change for higher education institutions in the United States. The report further states, “The evolution of the global environment presents both challenges and opportunities for higher education. A prerequisite for success in this new era will be active, ongoing engagement on the part of colleges and universities in the United States with institutions around the world.” In addition, Duderstadt [3] asserts that higher education is intimately interwoven in the process of globalization. The institutions of higher education have an opportunity and responsibility to play their role in creating knowledge and awareness about all aspects of globalization and in preparing their students with global competencies. Therefore, an ongoing engagement between the institutions around the world is necessary for our societal success. Brustein [4,5], and Commission on International Education [6] suggest that engineering education is no exception and the institutions of higher education have a responsibility to play their role in creating knowledge and awareness about all aspects of globalization and in preparing their engineering students with global competencies. Hunter et al. [7] reports that global competence implies “having an open mind while actively seeking to understand cultural norms and expectations of others, leveraging this gained knowledge to interact, communicate, and work effectively outside one’s environment”.

For the last few decades, the phenomenon of globalization has softened the national boundaries. The connectivity continues to increase, and international travel keeps growing. Information flow around the globe has become almost instant. The awareness continues to increase about other cultures, traditions, and values. The world has essentially become a global village. The events in one part of the world are no longer local and they impact rest of world as well. Engineers

frequently find themselves working on multinational projects and multinational teams. That platform can be effectively used to create an environment of respect, trust, and ethics. Such interactions lead to better understanding of each other with many different traditions, cultures, and values. The best outcome of a such as environment is reduced chances of violence and better prospects for peace.

The focus of this paper is to promote peace through educating and producing globally competent engineers. Educational institutions have always focused on finding solutions to the challenges a society faces. Most of these practical challenges involve engineers. After the engineering solutions to the current challenges have been found and implemented, a new set of societal challenges will emerge. Educational institutions accept the new challenges and start working on finding a new set of solutions. This cycle of progress to improve the quality of life of humans continues and leads to a better and peaceful world.

## II. GLOBALIZATION, PEACE, AND EDUCATION

According to Altbach and Knight [1], globalization is a process of economic, political, academic, and societal (including cultural) forces pushing for greater international involvement. It leads to integration of cultures, politics, economies, businesses, trade, and knowledge [8].

Stiglitz [9] suggested that globalization is a result of continuously increasing interactions among groups, corporations, societies, nations, and countries. The nature of the process of globalization and complexities associated with interactions among groups, societies, and nations are non-trivial. He highlighted the sentiments that some of these global interactions are viewed as intended and some as unintended; some groups/nations drive these interactions to push their agendas and some are being driven into these due to their vulnerabilities. He emphasized the need for these interactions to be fair, to pay attention to the poor and the rich, to have a basic sense of decency, and to reflect social justice.

The process of globalization and the view of the world as a global village often are mentioned together. Increased level of international trade and economic interactions, establishments of multinational corporations, greater level of movement and migration of people (with a variety of cultures and social values), higher level of awareness of the world, and the easier and almost instant flow of information and global communication are expected to have profound impact on cultures and social norms. This not only is widening and deepening the feeling of connectedness among individuals, groups, and societies, it also is setting a transformational tone for social relations. Some segments of society may view such transformations as a threat to their identities, culture, and independence. That may lead individuals or groups with similar social values and cultural norms to extend their

affiliations globally and not integrate with other groups as deeply as they could. This, of course, may cause a different type of division among segments of a global society.

Academic pursuit always has been a part of human development. People have been traveling across the continents for the purpose of advancing their knowledge. The process of globalization continues to open the doors to that opportunity. It also is anticipated that the status of different countries in the future will depend increasingly upon the level of literacy and the amount/nature of the knowledge these countries have and the knowledge they will create. Knowledge will be considered a major resource. Higher education institutions are in an enviable position to play an impactful role in the knowledge-based interactions among countries of the world, and globalization is providing unique opportunities for that to occur [1].

There are diverse opinions about the opportunities regarding the interactions between globalization and academia. Some feel that globalization creates an environment and incentives for the masses to seek higher education. Others feel that there may not be enough time and resources for people to avail all the opportunities globalization has created. Keeping all aspects in view, the process of globalization offers higher education institutions an opportunity for a positive engagement with and in the process. Higher education institutions, by creating awareness among masses, can reshape the trajectory of social change leading to a peaceful co-existence of diverse groups.

Despite differences of opinions held about globalization, many feel that globalization is here to stay and to grow. Combined with the growth of emerging information and communication technologies, increased access to knowledge, and greater awareness of the world, globalization means that national boundaries will not remain too restrictive [10,11,12]. Academic institutions have a significant responsibility to position the world population for making the best use of the opportunities created by the process of globalization and for producing graduates with global competency skills [7].

Organizations such as Doctors without Borders and Engineers without Borders have emerged with altruistic motivations and are growing. Information (and knowledge) is one of the major propellants for globalization. Therefore, it is a reasonable expectation and an uneasy consensus that globalization will continue to have a profound impact on the exchange of knowledge across borders. As creation of new knowledge is one of the main activities of higher education institutions, it is logical to conclude that educational institutions around the world will be affected by the phenomenon of globalization. Increased access to education is expected to propel the process of globalization and that, in turn, will increase the demand for education. This cyclic interdependency is expected to continue and to grow.

Brustein [4] emphasized that in a globalized world, countries are facing rapidly shifting economic, political, and national security challenges. To respond to these challenges, it is essential for institutions of higher education to prepare graduates with global competencies. Without those competencies, the graduates will not be fully prepared for global citizenship, will lack the skills required to address national security needs, and will not be able to compete successfully in a globalized world. The skills required for global competencies include the ability to work in international and culturally diverse settings, respect different points of views and opinions, and an awareness of the global dynamics. For imparting these skills, institutions of higher education will need to revise their curricula and build faculty expertise to ensure the outcome.

For making necessary changes in academia for imparting global competence skills, it is essential to understand the global demographics and profile of today's students. It is obvious that the world is changing very fast. Its population has more than doubled over the past 50 years. The knowledge reservoir is experiencing exponential growth. New technologies continue to increasingly impact our lives. The process of educating and learning is no exception. The current status and future trends require that academic institutions be prepared to adapt rapidly to the changing requirements in terms of society's needs. They also need to adapt to a mix of students who are growing up with technology. Today's students are very different from the generation of students of only a few years ago. They think differently, work differently, socialize differently, and approach challenges differently [3]. They also are much more aware of globalization and global issues. Academic institutions must adapt to educate this new generation of students to meet the societal needs on a global scale.

In doing so, the higher education community must emphasize the importance of peace, human rights, and social justice in this emerging globalized world. As engineers find themselves working in multinational corporations and traveling around the world, it is essential that engineering education focus on global competencies. In doing so, the educational institutions will have opportunities including the following:

- To educate students about all aspects of globalization and its nuances;
- To create awareness about global society needs;
- To prepare students with global competency skills;
- To embrace all kinds of differences and to promote mutual respect;
- To research the topics related to globalization, to share the knowledge, and to make a global impact on issues such as access to education, poverty, social justice, peace, sanctity/dignity of human life, sovereignty, and more;
- To be an agent of global change for good;

- To establish partnership with institutions in other countries;
- To enhance the study abroad programs for students; and
- To enhance the faculty exchange programs.

This paper has a noble purpose of making this world a better place for all through education particularly engineering education. Higher levels of education have a strong correlation with better employment opportunities and thus higher earning potential [13] leading to better prospects of harmonious co-existence. The process of globalization enhances to education and continues to provide opportunities for people to understand different cultures, build bridges, find solutions for the world problems, encourage communication with mutual respect, and work together for making this world a better place. It is hoped that an educated world will be a peaceful world. The global society is essentially going through this transformation. Knowledge will be considered a major resource. In a globalized world and information-intensive society, this resource travels much faster. This paper did not explore factors that lead to (rare but real) potential misuse of knowledge by some misguided individuals to harm humanity.

The next section discusses objectives of this paper and discusses global competencies needed for individuals to become a productive and effective global citizen. The focus is on engineering education and curricular elements that equips engineering graduates with global competencies contributing to a better and peaceful global society. In section III, the paper discusses an approach to assessing the effectiveness of approaches adopted by the institutions of higher education.

### III. OBJECTIVES

The objective of this paper is to identify actions items needed to enhance the ability of the higher education institutions to educate and produce engineers with global competencies. A follow up objective is for these globally competent engineers to promote peace through respect, trust, and ethics. Institutions of higher education may have different approaches to addressing globalization based on many factors including their mission, vision, resources, and service region. However, with the rapid pace of globalization on the rise, higher education institutions are assessing on a regular basis and are making necessary adjustments to their operations to prepare their graduates with global competency skills to be successful in a globalized environment [7]. Many researchers, including Brustein [5], have suggested that due to shifting economic and political realities, academic institutions must have the following characteristics for addressing globalization needs:

- An adequately diverse and international population of students both ethnically and geographically;
- A robust access study abroad programs;
- Adequate faculty/student exchange programs with

universities around the world;

- Curriculum that reflects global awareness, internationalization, and multicultural aspects; and
- Broad commitment to producing globally competent graduates.

The universities with these characteristics are being referred to as “global universities” [14].

#### IV. ASSESSMENT

To assess institutional ability to produce globally competent engineers and their ability to promote peace through engineering, a few representative parameters are suggested to represent globalization characteristics of higher education institutions. These parameters typically relate to population of international students, study abroad programs, budget allocation, relevant courses, exchange programs, and enrollment [5]. Although choice of these parameters may seem arbitrary they represent what most of universities are using to address globalization needs. These parameters may need to be adjusted from time to time as the globalization landscape changes. The selected parameters values can be combined with equal or variable weights to compute a single value – globalization index – to represent the state of preparedness of an institution of higher education to address globalization challenges and opportunities. The suggested parameters are:

- Percentage enrollment of international students (abbreviated as international);
- Number of study abroad programs and enrollment;
- Percentage budget allocation for international programs, study abroad programs, and related activities;
- Percentage number of courses related to international and/or global education;
- Percentage enrollment in courses related to international and/or global education;
- Number of student/faculty exchange programs;
- Number of strategic plan goals/objectives related to globalization and internationalization; and
- Number of degree programs offered in other countries.

Based on these parameters, a globalization index can be defined and computed for any institution of higher education. The following steps are suggested for computing the globalization index. As a first step, the data with numerical values are collected in the form of  $m$  parameters. These values of these parameters can be represented by variable  $p_{i,u,y}$  where  $i$  represents one of the  $m$  parameters for university  $u$  and for year  $y$ . The next step is to normalize these values with the highest possible value of each parameter. The normalized parameters  $NP_{i,u,y}$  will have a value between 0 and 1. The normalized values can be combined to compute Globalization index with an appropriate weighting factor for each parameter [15].

The values of the weighting factors can be equal for all parameters or different for each parameter. Different values imply that some parameters weigh more heavily than others in computing the globalization index.

The proposed globalization index essentially combines various parameter values that are directly or indirectly related to globalization aspects in an institution. The parameter values can be for a semester, academic year, calendar year, or any other suitable duration of time.

The index provides a composite value that quantifies the state of preparedness of an institution and represents how effectively an institution to addressing the globalization challenges and opportunities. For a single institution of higher education, the globalization index can be used for tracking its progress in meeting its targets for globalization preparedness. The index can also be used to compare one institution’s state of preparedness with that of another institution or other institutions.

The index can also be used for trend analysis and to make future projections about the state of preparedness of an institution of higher education for addressing globalization aspects. For any trend analysis or forecasting to be meaningful, parameters values for several years will be needed. Trends can be computed over several years and in several forms including linear, exponential, polynomial, or logarithmic. One of the simple and effective tools for trend analysis Microsoft Excel’s statistical tool for quantitative data analysis and trend lines. Microsoft Excel’s trend analysis tool determines the relationship between independent variable and dependent variable, and develops an equation that fits the data being analyzed which is in turn used to establish trends.

Reliability and validity of any research depend upon the integrity of data used in the research. Reliability refers to the probability of replicating research findings. Validity questions if the researcher is indeed measuring what the researcher thinks he or she is measuring [15]. Collecting data from credible sources and through reliable means also contributes heavily to the reliability and validity of research findings.

Several strategies have been suggested in the literature for promoting and/or improving reliability and validity of research. The following strategies seem appropriate for improving validity and reliability of data:

- Triangulation – using multiple sources and cross checking to ensure validity,
- Researcher’s reflectivity – critical self-reflection by the researcher regarding assumptions and biases that may influence research, and
- Peer review – frequent discussions with researchers about the research process, current form of research findings, and interpretations.

Every effort should be made to extract the research findings, prepare trend analysis, and forecast projections from the information collected in an objective manner. Use of normalized values of parameters in computing globalization

index in a consistent manner also improves the reliability and validity of research process and research findings.

## V. FUTURE RESEARCH

As globalization is an evolving phenomenon, and as higher education institutions position themselves to respond to the challenges of globalization, tremendous future research opportunities are expected to surface. In addition, there will be a need to measure globalization for the purpose of continuous assessment and improvement. New parameters relevant to globalization may be added to supplement or replace previous parameters to modify the globalization index with equal or variable weighting factors. Entirely new methods of measuring globalization could be an area of future research. Trend analysis and forecasting to assess the effectiveness of various approaches to globalization could be another area for future research.

It also would be interesting to compute globalization index on a regular basis to assess how effective the trends and/or projections have been. Assessing the impact of rapidly emerging technologies including social media on the evolution of globalization could make another research study.

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